

## LA-UR-21-22447

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Title:	Benchmark Testing on the IBM-Q Network
Author(s):	Culhane, Candace Streuli
Intended for:	Proposal that will be submitted to Institutional Computing to obtain an account login for the IBM-Q network
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# Benchmark Testing on the IBM-Q Network

## **Project Summary Information:**

- Principal Investigator (PI): Candace Culhane, ALDSC, culhane@lanl.gov
- Other investigators (Laboratory and external):
  - Stephan Eidenbenz, CCS-3
- List of sponsoring programs or agencies
  - N/A

**Research Abstract:** The goal of this project is to evaluate a proposed set of candidate benchmarks being developed by the Standards and Performance Metrics Technical Advisory Group (TAG) of the Quantum Economic Development Consortium (QED-C), of which LANL is a member. The QED-C Standards and Performance Metrics TAG has developed implementations of several benchmark codes with the hope and expectation that these codes will be helpful to QED-C members interested in investigating various quantum computer platforms. The benchmark set will be run on LANL's access to the IBM-Q system with the intent to evaluate the set for scalability, correct execution, and coverage of the application space. The goal is for the QED-C Standards and Performance Metrics TAC to be able to produce a coherent, consistent, scalable set of benchmarks that will run on multiple quantum computing platforms and will be available to members of QED-C, including LANL.

## **Resource Requirements:**

Researchers can gain free access to very small scale quantum computing technology from IBM via cloud access. This proposal seeks to gain access to IBM's cutting edge, state of the art quantum computers, which can only be accessed through the IBM-Q network using a license from IBM, which LANL currently has thanks to Institutional Computing. The intent to run the benchmark suite on a subset of IBM-Q Networks top end systems, keeping note of the different configurations and the all aspects of the job run. The only other requirements are for a standard lab laptop [already in hand] for accessing the LANL server to enter the IBM-Q network, and for recording the results of the investigative runs.

## **Project Plan:**

Work is expected to commence within ten working days of gaining access to the IBM-Q network. Runs are expected to be completed within thirty days after gaining access. A summary of the investigation as well as an assessment and recommendations (if any) will be completed within fourteen days after completing the runs. Known risks: it is possible that the code provided by the TAC has programming flaws which may need adjustment. Feedback on the quality of the code will be provided to the TAC.

**Project Impact and Value:** LANL has a strategic interest in being a leader in Quantum Information Sciences. LANL is already a member of the QED-C, and thru experimentation with these draft benchmarks will be positioned to provide feedback to the QED-C TAC. In addition, LANL will benefit from this curated set of benchmarks as they may be well suited to be run on other quantum computing systems that LANL develops interest in.

**Team Qualifications and Prior Experience:** Ms. Culhane is a program/project director with a computer science background and programming experience. Ms. Culhane has been part of the QED-C TAC developing the benchmarks and is well positioned to obtain information as needed from the QED-C TAC. Dr. Eidenbenz has years of experience working with quantum computing in general and is very experienced with the IBM Q Systems network.

**REFERENCES:**

N/A